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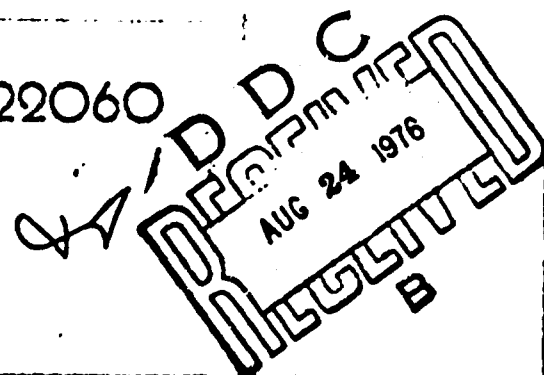
STUDY PROJECT REPORT
PMC 75-1

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Study Project Report

Individual Study Program

Defense Systems Management School

Program Management Course

Class 75-1

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by

Robert B. Wilson
Major USA

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This study project report represents the views, conclusions and recommendations of the author and does not necessarily reflect the official opinion of the Defense Systems Management School or the Department of Defense.

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EXECUTIVE SUMMARY

The purpose of this study project was to look at the acquisition management of military engineer construction equipment to determine if aggregation under centralized management might be more effective in achieving the overall management task. Its specific goals were to (1) review the overall DOD requirement for construction equipment (Section II), (2) to look at the current acquisition management organization/procedures for construction equipment (Section III), (3) to evaluate the current organization and procedures (Section IV), (4) to address the question, can/should the management task be consolidated? (Section V), and (5) to draw conclusions and briefly present implications, if appropriate.

The project is important not only to the author (an Engineer Officer and participant in the Project Manager Program) but to the materiel acquisition community and particularly the Corps of Engineers.

The approach used was to describe the principal programs and then determine who is managing what, and how it is being accomplished. A search was made for studies and reports concerning the subject and then personal and telephone interviews were conducted with managers, supervisors and staff persons in selected headquarters and organizations in an effort to determine just how the management task is carried out. Problem areas and how they impact the situation were sought out and discussed. The study indicates that the US Army is the principal user in the DOD, and although each of the other departments has some requirement, there is no R&D effort outside the Army. Participation in Army buys was found to be often the case. The Army programs are well defined but there is separation and some division of R, D and E responsibility within USAMC. The situation

is still in the process of change due to recent reorganization activities with the prospect of more to come as a result of the Army Materiel Acquisition Review Committee (AMARC) recommendations.

The complementary nature of the programs, the single user and considerable commonality among requirements and interface problems and the need for standardization and rationalization of a realistic parts support program in the Army, suggest that centralization of the management task may offer significant benefits that warrant further consideration and perhaps an official study of greater magnitude and depth.

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

Executive Summary

Acknowledgements

Sections

- I Introduction
- II The Requirement for Construction Equipment in the Department of Defense
- III Current Acquisition Management for Construction Equipment
- IV Evaluation of the Existing Procedures
- V Can/Should the Management Task Be Consolidated
- VI Conclusions and Implications

Bibliography

SECTION I

INTRODUCTION

The intent of this paper is to look at acquisition management of military construction equipment, principally horizontal construction type equipment, within the Armed Services with primary focus on the Army to determine if a more centralized or consolidated approach might be more effective in achieving the overall management task.

The predominant users of this equipment in the DOD are US Army Corps of Engineers units in the execution of their role in support of the ground combat forces. The second largest user is the Navy Construction Battalion whose mission is somewhat different than that of the Army Engineers but who are also engaged in principally horizontal (roads, bridges and airfields) with some vertical (buildings) type construction.

The Marines also use similar equipment but their requirements are quite small in comparison. The US Air Force does not have an engineer construction role per se, this is to be accomplished by the Army, but they do field an engineer unit in support of their bare base concept and construction equipment is found at some bases to provide a repair and maintenance capability.

The paper is organized into six sections with the material substance appearing in the remaining five. Section II addresses, briefly, the individual service requirements to include the type and general magnitude; the nature of the civilian industry is touched upon; the categories of equipment are identified and some indication of the problem is presented. Finally, the major Army programs are introduced as they will provide the focus for later discussion.

Section III deals with the services current organization for acquisition management of construction equipment and focuses on the primary user, the Army. Policies and procedures are discussed and intensive management programs in the Army are examined in more detail. The major Army programs, Family of Military Engineer Construction Equipment (FAMECE), Universal Engineer Tractor (UET), and the Commercial Construction Equipment (CCE) programs are explained, to include organization for management, programs background and current status.

Section IV explores strengths and weaknesses of the existing organizational relationships and staffing procedures. Comments as a result of personal interviews are included and reference is made to the Army Materiel Acquisition Review Committee (AMARC) report. Army Materiel Command (AMC) organizational changes underway and those proposed as a result of the AMARC recommendations are discussed to include the rationale behind the changes. Army programs are discussed in light of some of AMARC's criticism.

Section V addresses the question, can/should the structure, policy and procedures for managing acquisition of all engineer construction equipment be improved by consolidating or centralizing authority and responsibility under a system management scheme or a DOD program manager. The current Army organization responsibility for management of this equipment is looked at and specifically the FAMECE/UET and CCE programs are addressed. An existing DOD program management organization, PM for Mobile Electric Power (PMMEP) is discussed as a case in point for centralizing management where proliferation of makes/models was a problem and commonality of requirements was high among services.

Section VI summarizes the main points of the paper and addresses implications for future consideration.

The methodology employed in researching this topic was to search various reference repositories for studies concerning acquisition management for similar type materiel in the DOD and other studies/papers dealing with the general subject of management centralization in acquiring DOD weapons/materiel systems. This search revealed a lack of material concerning management of construction equipment. In addition to the documentation reviews, interviews were conducted with managers/supervisors and staff persons currently involved in construction equipment acquisition.

SECTION II

The Requirements for Construction Equipment in the DOD

Each of the Military Services has a requirement for horizontal and vertical type construction equipment. The Army construction mission of the Corps of Engineers has the greatest requirement in the combat support and combat service support role accounting for approximately 17,000 construction vehicles. This includes a wide range of equipment types and categories, e.g., earthmoving vehicles such as dozers, scrapers, graders and dump trucks; and support type items such as compressors, distributors and welders (1:1-B-6). The Navy Seabees have the next largest requirement in equipping their 10 construction battalions while the Air Force need is smaller in support of bare base site preparation tasks by civil engineering squadrons. The Marines also have a much less requirement for their division equipment battalions and the force equipment battalions.

Unlike the Weapons System Acquisition business, with no civil market responding to widespread domestic demand, the construction equipment business has a well populated industry engaged in competitive free enterprise and independent research and development aimed at capturing a share of a large multibillion dollar annual equipment sales program. For the most part, the services are able to take advantage of this ready source, as some of the programs will reveal.

The Army construction equipment requirement, as the other service requirements is determined by the nature of the tasks involved. Basically, there are two mission types to be fulfilled: First, the divisional combat engineer battalion moves with and supports the division in the forward

combat areas, performing pioneer and other engineer tasks designed to facilitate the movement of combat forces. Their equipment must be highly mobile, of moderate to high capacity, be capable of internal airlift, and be extremely rugged and supportable in the field under combat conditions. Second, the combat engineer battalion, heavy, formerly the construction battalion, operates behind the forward combat elements carrying out general engineer tasks -- principally lines of communication (LOC) work, airfields, and to a considerable extent, vertical type construction, such as POL dumps, supply and maintenance facilities and troop housing. There is also a requirement for ports and harbors type construction requiring specialized equipment. The airborne/airmobile support requirement, a variant of the first, must also be considered. This equipment, usually smaller, lighter weight design, must perform the same type mission as the combat engineer battalion except that it must all be air transportable by medium lift helicopter (CH47). The work capacity of this equipment (commercial design) is generally not as great as that of the non-airborne-airmobile battalions. The Army requirement exists in more than a dozen different types of engineer units and total vehicle/equipment items number in the thousands.

The Navy Seabees organization (mobile construction battalion) performs in a role not unlike the Army engineer battalions as they too engage in horizontal and vertical type construction activities in support of the Fleet Marine Force and naval forces land support requirements. A second type unit, the Amphibious Construction Battalion, supports over the shore operations. A principal difference in Army and Navy equipment lay in the lack of a Navy requirement for airlift capability. The Seabee

units, 8 active mobile battalions and 2 amphibious battalions. approximate in size, equipment types and mission requirements of the Army combat battalion, heavy, each containing 275-300 pieces of civil engineering support equipment (2).

The Air Force construction equipment requirement stems from their bare base site preparation task by civil engineering squadrons. (NOTE: The Air Force construction task has traditionally been fulfilled by the Army Engineers, as a part of their overall mission. The current civil engineering squadron was formed during the early 1960's to fill a need in Southeast Asia. The Air Force has not yet returned this mission to the Army Corps of Engineers).

The Marine requirement through small by comparison to the Army needs, approximates that of the Army divisional battalion and the heavy battalion. The Marine division equipment battalion supports the combat division in the forward combat area and the force equipment battalion (2 active) provides area support similar to that of the Army's heavy battalion in a general support role.

The equipment requirement (design) for all services falls into one of three basic categories. These are military design, military adaption of commercial equipment, or, modified commercial and commercial. The use of military designed construction equipment is occasioned when the nature of the requirement is such that no existing piece of commercial equipment can meet the need. Modified commercial construction equipment represents the largest part of the services present inventory. In these instances the equipment is basically commercial in design but modified in varying degrees to meet specific requirements. Examples of such require-

ments are extreme environmental operating conditions, blackout lights, lifting and tiedown attachments, airborne and airdrop capability, military standard parts utilization, and radio interference suppression. The third category consists of commercial items which can be procured without modification, either as a standard item or by specifying commercially offered option componentry. Both of these latter two categories are considered under the same generic title of Commercial Non-Developmental Items (CNDI), to distinguish them from full R&D programs (3:1-1).

The Navy Seabee, Air Force and Marine requirements are basically met by commercial and modified commercial programs. Because of the relatively small requirement of these services compared to that of the Army, further focus will be on Army situation. Currently the preponderance of Army needs are met by the modified commercial programs. This situation has given rise to a rather tremendous burden on the Army's logistic (repair parts) systems. Currently there are more than 92 makes and models of equipment in the inventory, much of which is very low density but which has to be supported none the less. The causes of this situation are many fold and beyond the scope of this paper but suffice it to say that the wide range of activities/tasks performed in the construction mission results in a wide variety of equipment types and this coupled with the relatively large number of manufactures in the equipment industry interacts to provide a largely heterogeneous equipment population, with attendant multiplicity of repair parts.

As a result of this situation and the need to improve the standardization and supportability of the equipment fleet at a reasonable cost level

and others, the Army is currently engaged in three "visibility" acquisition programs. The first two are developmental (military design) and the third is a commercial program. The first, the Universal Engineer Tractor (UET) is in the final stages of engineering "shakedown". This multipurpose tractor is intended to provide a single item replacement for medium weight crawler tractors in engineer units. The vehicle will also offer much greater versatility than the current crawler tractor (4:127). The second program will provide a Family of Military Engineer Construction Equipment (FAMECE) that will become the equipment nucleus for the Army's divisional engineer battalions (including airborne/airmobile). This program will go far in achieving standardization in engineer equipment and should result in savings in management, logistics and other support costs. These programs and their management will be discussed further in Section III. The third program is the Commercial Construction Equipment (CCE) concept designed to meet a large portion of the construction equipment requirement in the Army. The preponderance, in terms of numbers of items and principally larger, heavier, more complex pieces of equipment/machinery, occurs in the heavy battalion and its collateral support units in the general support mission to the rear of the combat elements. This program is designed to keep a modern equipment fleet as standardized as possible by going directly to the commercial construction equipment industry, bypassing R&D for all intents and purposes, and relying on them for support, i.e., repair parts and warranty, as well. The CCE program and its management will be discussed in Section III.

In addition to the above mentioned programs, there is a heterogeneous fourth group of construction support items such as crushing and screening

plants, drilling machines and bituminous distributors that are not managed as a program per se but are handled individually by the Tank Automotive Command (TACOM) functional staff.

SECTION III

Current Acquisition Management for Construction Equipment

The Air Force, Navy and Marine requirement is, as mentioned in Section II, small compared to the Army requirement. It would not be meaningful to discuss, in any detail, the management procedures employed because we are basically looking at an off the shelf buying situation, no R&D effort and in many instances an add-on to Army buys. Each of these services do, however, have staff elements managing the acquisition process but not significant compared to the Army system. Thus, this section will focus on Army organization/procedure for managing the acquisition process, the commodity oriented major subordinate commands of Army Materiel Command, AMC.

In general, the evolution of military design construction equipment, from concept/requirement identification to fielding is the same as for any other weapon/equipment system, i.e., total system life cycle management is carried out and managed within AMC and, in this case, within Tank Automotive Command (TACOM). For the purpose of providing background and clarification for later discussion, it is noted here that the engineer construction equipment acquisition and readiness mission was transferred, in July 1974, to TACOM from a sister command, US Army Troop Support Command (TROSCOM), (Formerly Mobile Equipment Command (MECOM)), where it had been placed after a major reorganization within AMC in 1973. The R, D and E mission has traditionally been assigned to Mobility Equipment Research and Development Center (MERDC), until recently, a part of TROSCOM. In March 1975, MERDC became a separate research and development center within AMC (5).

TACOM, as with other AMC major subordinate commands, is organized to basically accomplish two missions, systems acquisition and readiness. Acquisition management for non-major and non-selected non-major systems/equipments is decentralized and is accomplished within the Research, Development and Engineering Directorate, Procurement and Production Directorate, and Quality Assurance Directorate and supported by the various Logistics Support--e.g. Materiel Management and Maintenance Directorate--and Resources Support--e.g. Personnel, Training and Force Development--Directorates. These items are managed routinely by the staff of the Materiel Acquisition Directorates and at the appropriate time, following entry into full scale production, are turned over to the readiness or Logistic Support side of the staff for field support. Those systems/equipments that do not qualify as major systems and thereby intensive or project/product management but which, nonetheless, require special handling for any one of a number of reasons, may be assigned Special Item Management (SIM) status and will be shepherded by a project officer in the Special Item Management Office. Here, centralized management, planning, scheduling, reviewing and coordinating activities are exercised by a small element of up to five persons per project. The actual Weapon Acquisition Process (WAP) work effort or functional support is still accomplished by the various staff Directorates as discussed above but in response to the coordinating activities of a dedicated project element (6).

Three Army construction equipment programs (all major items) currently qualify for special management. FAMECE, UET and CCE. These programs are designed to eventually meet most all Army requirements for construction and construction support equipment. CCE is expected to be used primarily in

combat service support engineer construction units (rear area support), where the construction mission and techniques of heavier construction more closely resemble the operations of a civilian construction contractor. Current plans are to use the FAMECE and UET in combat engineer units. The FAMECE vehicle will combine a standard power module with compatible construction work module in offering versatility exceeding current capability and will be particularly suitable for use in combat support construction operations. The family of modules features production capacity that exceeds current equipment capacity, has high reliability and low maintenance requirements. The family of 9 modules will significantly reduce the multiplicity of makes and models of existing equipment currently authorized.

The family includes a dozer, bucket loader, scraper, grader, smooth-steel drum pneumatic tire compactor, tamping-foot pneumatic tire compactor, dumper and a water distributor. Each module (power module or work module) will be capable of being airlifted as an external load by the US Army medium lift helicopter of the 1975 time frame. A complete vehicle (power and work module) will be capable of being transported as an internal load and airdropped from USAF aircraft (C130E, C141 and C5A) (7).

Development authority for FAMECE was granted by DA in July 1965 and Advanced Development Objective (ADO) was approved on 13 May 1968 with a total procurement planning buy of 12,000 vehicles. The requirement was subsequently revalidated by DA with approval of the Advanced Development Plan (ADP) in 1969. The Qualitative Materiel Requirement (QMR) and a Tentative Basis of Issue for 2,000 vehicles (reduced from 12,000) was approved by DA in 1970. In April 1971, following a formal In-Process Review (IPR) (Army milestone review and approval process below ASARC), DA approved the FAMECE

program to enter the Validation Phase (VP) of the acquisition process utilizing competitive contractors to develop prototype hardware for government testing and evaluation prior to the decision to enter Full Scale Development (FSD). This was accomplished during 1972 and 1973. The contractors delivered their prototype power modules and two work modules each for testing in January 1974. Testing and evaluation of the prototypes was completed in July 1974. Another IPR was held and DA approved entry in to the FSD phase. Source selection procedures was completed in September 1974 and a contract awarded to one of the VP competing contractor in December 1974. The FSD phase will continue into mid CY 1978 with Low Rate Initial Production (LRIP) scheduled to begin following successful DT/OT II testing during the latter part of 1977 into mid 1978 (10).

Management of the FAMECE program began in the Special Item Management Office (SIMO) at MECOM (now TROSCOM) in 1970 and, was elevated to Product Management (PM) in 1972. At the same time the UET was designated for product management and was included in the FAMECE PM charter. The PM was delegated full line authority of the Commander, AMC, for centralized management of his programs. The TOA authorized 24 civilians and 3 military spaces. In July 1974 the organization was transferred from TROSCOM to TACOM along with the transfer of most of the construction equipment mission (4:113). Since its inception, the PMO has been located with MERDC at Fort Belvoir, Virginia. MERDC is the Army lead laboratory for research and development of engineer equipment.

The UET mentioned above has been under development since 1958. Research and Development activities are substantially complete, however, the vehicle has not been approved for production. The UET is a multi-purpose tracked,

armored, amphibious combat engineer vehicle capable of performing dozing, scraping, rough grading and hauling. It has a limited swim capability, is air transportable, and provides light armor protection for the operator. It is designed for use by division and non-division combat engineers to perform the essential combat engineer tasks and provides for the replacement of the medium weight crawler tractors now in the inventory. The Tentative Basis of Issue involves 353 vehicles. Prior to its designation for product management and inclusion under the FAMECE Charter, UET was a SIM item handled by an officer assisted by one civilian.

The third program for discussion is the CCE program currently under Special Item Management at TACOM. This variant of the Army's commercial nondevelopmental items (CNDI) program provides a procedure which enables the Army to procure low density commercial construction equipment with virtually no development costs except for a limited selection/evaluation survey of competing manufacturers items. The program may eventually include more than 150 different end items ranging from 225 ton per hour crushing and screening plants to a steel wheeled roller (6). Currently 8 different items of equipment have been bought. Typically, the numbers of each item, of course depending on the types, procured will be fewer than 500. For some items, however, such as graders, dozers and dump trucks for active and reserve TOE's, the requirements may exceed 1,000 units. The CCE program has no phase comparable to the conceptual and validation phases of the WAP. Instead, it is recognized that the construction industry, due to natural market forces, has long recognized the need for and has practiced continuous modernization of equipment through independent research and development. The program actually starts in what might be termed FSD, when the individual item ROC is

prepared by the user in concert with the materiel developer, MFRDC. This ROC is atypical in that it describes in general the commercial equipment available which satisfies the requirement. Candidate acceptability is then determined through technical evaluation and field evaluation, of commercial user experience, by US Army Test and Evaluation Command. Concurrent with the evaluation, the ROC is being coordinated and staffed to DA for approval. Following these steps a coordination conference (in lieu of an IPR) is conducted to review the evaluation effort and to determine acceptable candidates. In the final analysis, the ROC reflects the requirements as met by the acceptable candidates. This conference satisfies the DP required IPR. If the user and the materiel developer can not agree on an items qualification for candidacy, it is resolved at HQ DA. RFP's are then sent out to the selected candidate manufacturers and a contract awarded accordingly. Unlike other SIM programs, CCE is managed from two places; by an office at TACOM (7 persons) where the project officer interfaces with the functional elements on the R and D side for items in development and on the readiness side for those in procurement/production status, and by a liaison office at Fort Belvoir, Virginia. Here additional R&D interfacing/coordination is effected with the materiel developer, MERDC, and the user representative, the US Army Engineer School (6).

SECTION IV

Evaluation of the Existing Procedures

Discussion of the construction equipment management organizations and procedures of the Air Force, Navy and Marines will not be particularly meaningful for reasons mentioned in Section III. One comment though seems in order. Since most all the equipment involved is off the shelf, commercial type equipment, and since much of this is actually procured via Army buys, there appears to be little in the way of actual acquisition management being accomplished that could not perhaps be done by a single agency or office. This could eliminate duplicative, generally routine effort, i.e., no R&D involved. This aspect will be discussed further in Section V, as the remainder of this section deals with the Army situation.

In the Army, construction equipment has not always had the same home, as mentioned earlier. It does not fit, neatly, in any of the commodity commands. Starting in Mobility Equipment Command (MECOM) and then assigned to Troop Support Command (TROSCOM) following the AMC major command reorganization in 1973, it was assigned to Tank Automotive Command (TACOM) in 1974. TACOM's function's encompass integrated management of wheeled vehicles and track vehicles and their responsibilities include the design, development, procurement, production, maintenance, supply and repair parts support of the Armed Forces Vehicle Fleet (4:3). Since most construction equipment is wheeled or tracked, it is now assigned to TACOM. However, it is noted that CE R&D activities have been traditionally accomplished at MERDC, and most construction equipment is special purpose, is comprised mostly of low density items compared to other vehicles managed by TACOM and

consists, generally, of commercially available items from a well defined highly competitive industry civilian market oriented.

The major development programs, FAMECE and UET, are managed for the CG TACOM by a product/project (project charter at HQ AMC for approval as of April 1975) manager physically located with MERDC at Fort Belvoir. CCE is selected item managed within the TACOM staff. Hence, the Army's major construction equipment programs are all afforded "intensive management". The FAMECE/UET project management organization appears adequately staffed to handle the tasks assigned. The PM's charter states "the Product Manager is responsible for project management of FAMECE and UET in accordance with DOD Directive 5000.1, AR 1000-1, AR 70-17, AMCR 11-16, and other pertinent regulations. "Included in the charter is the requirement for short range coverage of airborne/airmobile engineer construction equipment until FAMECE is a realized program" (8:1). This program was initiated in 1971 in MECOM and designed to provide the airmobile engineer units with the most technically advanced commercial equipment available within the size and weight constraints that could allow delivery by medium lift helicopter (9:1). This program will fulfill the interim requirement as FAMECE is scheduled for eventual deployment to these units. The FAMECE IOC is scheduled for late CY 1980 (10). Assignment of this program to the FAMECE PM insures responsiveness in meeting the users needs by utilizing the centralized and intensified management environment of project management; i.e., it reduces the coordinative effort by presenting a single point of contact and eliminates time consuming, normal, lateral coordinative effort within the functional organizations and also eliminates the layering effects of staffs and headquarters of the interested organizations. Addi-

tionally, it places its management in the hands of those who are dedicated to the acquisition program(s) for construction equipment and who interface continually with support activities, the user and who are in the best coordinative and integrative position to achieve early, efficient program implementation.

The CCE program, on the other hand, in the past and as of now has been retained for SIM within the TACOM staff. Here, as mentioned earlier, the program is managed by a single project officer in the Selected Item Management Office and is supported by the various functional staff elements. Given that type organization, i.e., as discussed briefly in Section II, the SIM concept was a preferred alternative to total functional management, assuming that the system/item followed the normal cycle through the R&D and later production/deployment phases of acquisition. However, this system/procedure has been under criticism from different quarters, both from within the Army and without, i.e., DOD and the Congress.

In a continuing effort to improve the acquisition process, in 1973, the Secretary of the Army established the Army Materiel Acquisition Review Committee (AMARC) (11). This body was charged with conducting a "comprehensive review, analysis and critique of the Army's Materiel Acquisition process, and for recommendations for improvement, with concentration on organization (especially AMC), and procedures" (11:I:1). The committee's report and findings are quite voluminous and cover the entire spectrum from the requirements phase through production and included people problems, organization problems and procedures problems. These latter two are germane to this discussion and include identification of at least four general weaknesses and consequent recommendations for improvement. Each of these

will be discussed as they pertain to the construction equipment situation principally CCE and will be referred to later in this paper. The points are:

1. Excessive staff layering (11:I:6;12;13).
2. Separation of management of new systems and major product improvements from logistics management (predominant influence) (11:I:12;13;25).
3. Establishing a policy of evolutionary improvement (11:I:7;9).
4. Insufficient coupling of user interests and the materiel developer (11:I:9;12).

The idea/problem of layering pertains not only to the commodity command structure, including HQ AMC but, of course also to HQ DA staff. Consideration of the latter is beyond the scope of this paper but the problem still exists and must be dealt with by the PM. At least he has the opportunity to deal with it. On the other hand, CCE, not being designated for product/project management, is subject to the procedures of traversing the numerous horizontal and vertical ladders of coordination and approval for actions that could be handled more expeditiously by a dedicated construction equipment (system) oriented group who could deal directly with the user and interface directly with the appropriate approval authorities. Of course, these same comments could also apply to any "functionally managed" system so it applies, generally. The PM escapes some of this, especially within AMC, but equally important, coordinative effort in lateral organization.

The second point, the problem of immersion of the development and logistics (readiness) functions, was highlighted in the AMARC study, "TACOM appeared to have very little total weapons systems research and development capability. Most of their efforts are directed toward the readiness mis-

sion" (11:11-7). It was recommended that the organizations evolve to separating management of new systems to include major product improvements from the logistic function. During the past year, TACOM has been moving toward that goal, initially by proposing redesignation the SIMO to a Weapons Systems Management Directorate, a straight line organization with no formal subelements, thereby permitting maximum flexibility of the directorate to concentrate their staff efforts where needed (12). This office was to be comprised of project officers assigned to each of the previously designated items/systems for SIM. A later proposal would have created a Systems Command with Logistics and Development subcommands. Most recently, however, the proposed organizational configuration includes a separate development center in consonance with the AMARC's recommendation that AMC laboratories be consolidated into mission-oriented development centers for R, D and E and materiel acquisition, with the logistics and readiness functions being performed by separate logistic centers. These development centers would contain consolidated installation and commodity command RD&E elements, project managers, support elements, selected user elements and command elements (13:1). This management/organizational scheme is of significance to the construction equipment question because MERDC is currently organized to perform the functions (for construction equipment) proposed by the TACOM concept for the development center versus the logistic center. TACOM's proposal identifies a Tank Automotive Systems Development Center (TASDC) and a Tank Automotive Logistics Command (TALC) each reporting directly to HQ AMC. The TALC would be primarily concerned with logistics aspects of fielded systems and minor product improvements. "The materiel acquisition mission of the development center will span 6.1

research through at least the first production buy, including the militarization of commercial equipment" (13:1).

This breakout and complete separation of the development and logistic missions provides several management efficiencies and leads toward long-term improvement of the materiel acquisition process. The foremost internal contributors to these improvements are the establishment of the contractor operated Advanced Concepts Laboratory and the use of REFLEX (a program which allows hiring and firing of people subject only to availability of funds--it is limited to R&D spaces). In addition to the improvement to the technology base brought about by competing contractor and in-house programs, the ability of the Development Center Commander to assess the overall development program and apply resources to those programs which hold the greatest promise for success portends significant potential for long-term improvement of materiel and the materiel acquisition process (13:2). It is noted through that one of the more difficult problems will be the determination of the break point for systems acquisition responsibility.

Several alternatives were considered in the TACOM study ranging from turning over at ASARC II when the materiel has completed design and test to doing all system procurement in the development center. The alternative selected was to retain the responsibility in the development center until the system is no longer receiving serious complaints from the user--this means well into production--in this way the system designer is forced not only to produce the items he has designed, but must also respond to the field for its problems during early development. It is during this phase of transitioning from pilot models to full scale production systems that

have historically caused major problems for the user (13:3).

As developmental systems mature and pass to the logistics side, the appropriate management personnel or office would pass with the system and preserve the corporate memory for that system (13:8). While this sounds good in theory, the practical benefits are not altogether clear. Unless there existed in the logistic command, the same individual expertise or grouping requirement in the same system, it is not clear how the corporate memory would be preserved. It is clear that individuals released from a specific management team could reenter the development stream and become a part of another management team consistent with their expertise. This situation increases flexibility in personnel resource allocation and offers obvious benefits.

Under this scheme, it would appear that until fielding through first buy, military adaptation of commercial items (MACI) and CCE programs should be in the development centers instead of the Logistics Command. However, the reverse is being proposed. The MACI and CCE programs are currently managed as "fielded systems", however, per the discussion in Section III, initially they should not be considered as fielded. CCE must undergo ROC preparation/coordination, a user survey and equipment evaluation process, a coordination conference (in lieu of an IPR), and candidate selection, before a contract can be signed. In addition, the initial provisioning for repair parts in the logistic pipeline must be ironed out (a problem area now). It should not be until after the items delivery and repair parts availability has been accomplished that the equipment can be considered as fielded. At that time, logistics management should take over from development management. It should also be remembered that the CCE program consists of many

pieces of different equipment items, each of which must undergo a separate evaluation/selection process. It is envisioned that the CCE program would be on-going as long as the requirement exists for this type equipment.

The third point concerns the establishment/implementation of a policy of evolutionary product improvement. This is exactly what the CCE program offers. The construction equipment industry is highly competitive with the larger manufacturers engaged in substantial R&D and a continuous, evolutionary product improvement program. The CCE program reaps the benefits of this industry effort and should result in a continually modernized equipment fleet. However, for this program to be successful, i.e., give the user what he needs and be able to support it in a timely fashion, it will require timely, heads up management during the initial acquisition stage (best offered by single point of responsibility).

The fourth point brought out by the AMARC study cited insufficient coupling of user interests and those of the materiel developer. This situation can and does exist in functionally or commodity managed programs and in project managed programs. However, due to the easily identifiable role of the PM, the explicitness of his charter, single point of responsibility and his advocacy role (where he needs all the user support he can muster and usually finds a co-advocate), the probability for this decoupling appears to be much less great than for the functionally managed system buried somewhere in the commodity command where it is very difficult to find an advocate. This overall environment should be improved, however, by the formation of development centers. Additionally, the lack of agreement on requirements is a major problem which can be traced to the lack of identity of the responsible individual to specify and manage the need. This lack

of identity causes continual change and obviates the capability to maintain a corporate memory" (11:II;22). This situation applies principally to the user but also applies, equally, to the materiel developer, as discussed above.

SECTION V

Can/Should the Management Task be Consolidated?

Given the situation just described, the idea of aggregating the management of construction equipment, i.e., combining the management of FAMECE/ UET and CCE will be explored and an attempt made to determine if there is justification for considering single management of service requirements. First of all, and particularly under AMC's new development center concept, there is room for argument, at least in the mind of the author, as to whether the research and development mission/effort for construction equipment might be assigned to MERDC vice the proposed TASDC. This task has traditionally been accomplished at MERDC and the Construction Equipment Division of the Mechanical Technology Department has, currently, as its mission, "the conduct of research, development and engineering programs and the provision of engineering support for quantity procurement of combat theater construction, earthmoving and clearing and highway maintenance equipment" (14:18-1). In the furtherance of this mission, one of the division functions is to "conduct a comprehensive program as required to meet Army objectives for materiel readiness, product standardization and logistic support of construction equipment" (14:18-2). Thus the FAMECE office was located at MERDC and Fort Belvoir, Virginia, for a variety of reasons not the least of which included the fact that it is the location of the R&D technological base. It is also the home of the Engineer Center and School and the user representative (actually the doctrinal home of the true user), close to OCE, HQ DA, AMC HQ and close proximity to the tester's proving grounds. This situation notwithstanding, the separation of R&D in

the development center and readiness in the logistic command seems to be a logical and beneficial move.

First, in the Army, where the primary construction mission resides, does it make any sense to consolidate the FAMECE/UET and CCE management tasks? This question was first broached in 1971 while the mission was assigned to MECOM. At that time each of these programs was separately managed by Special Item Managers (SIM). This exception management scheme was designed to lift designated programs from routine management within the bowels of the functional directorates and subject it to higher visibility via "centralized management, planning, scheduling, reviewing and coordinating activities associated with those high dollar value, or difficult-to-manage hardware systems" (15:1). The principal argument then was that FAMECE/UET program features and characteristics were compatible for joint management but that the CCE program exhibited entirely different characteristics, i.e., basically no R&D, support role vice combat role for FAMECE, and commercial design vice military design for FAMECE. Additionally, it was thought that a single manager would produce intensive effort on equipment which was neither justifiable necessary (CCE) and that the existing structure was adequate for the task. It was acknowledged that FAMECE/UET would qualify for product management due to dollar thresholds but that CCE and modified commercial equipment (CE) should continue to be managed by the SIM and functional directorates, respectively. It was also acknowledged that the FAMECE/UET PM should pick up airborne - airmobile equipment. During this time period, 1971-1975, the forecast dollar expenditures for CCE were about \$10 million yearly; for FAMECE about 3.8 million per year and for all other CE, about 37 million average per year (15:Ex 3).

More recently, in 1974, the PM FAMECE prepared a point paper for the CG TACOM, recommending transfer of the CCE office to the Office of the Product Manager, FAMECE/UET (16). The recommendation was not favorably considered. The principal benefits of this proposal included application of PMO resources, with minimum addition of SIMO spaces (net savings) to the CCE program which would achieve increased control with relatively small increase in effort, collateral benefits of more streamlined decision making and more efficient use of technical expertise (construction equipment is construction equipment). Duplications of data base would be reduced/eliminated and overall coordination with higher and lateral headquarters would be minimized because the same agencies/organizations would be involved. It would combine the management of complementary systems and thereby minimize conflicts and questions in military requirements and doctrine and would contribute to individual program credibility by identification of a single advocate.

These same arguments are valid today and perhaps even more so than before. The CCE program is expanding; the current spending level (average for FY 74-76) is about 36 million per year (17); and plans for the next several years indicate the need for a comparable funding level. In addition to this significant funding level, there are field evaluation activities, ROC preparation/coordination, specification preparation and type classification actions that must precede contracting. These are the activities of the PMO and could probably be handled more economically and expeditiously than the current SIM organization. The agencies/headquarters involved in these activities are located very near the PMO and an operating dialogue is ongoing as a result of other PM business. In addition to this situation, CCE

is currently experiencing difficulty in getting initial repair parts stockage in the pipeline. Parts supply for low density but wide distribution items has historically been a problem, particularly for construction equipment due to the myriad of makes and models fielded. The same system that supports complex weapons systems and common (very high density) items must also support something like the 10 ton roller where there are fewer than one hundred worldwide. The CCE concept is that commercial support manuals will be used and the manufacturer should support the equipment with repair parts stockage and their standard warranty. This concept is being held up by DSA procedures which take 12-15 months to achieve initial support (6). Difficulties such as these might be more easily overcome by single point responsibility of the PMO and the high level visibility/decision making that characterizes this type management. Under consolidated management, the CCE items would be turned over to the logistics command for readiness management as soon as an item is fielded and supportable by a stocked supply system.

What is being suggested here could, perhaps, be construed as creating an aberration in the project management concept as implemented by DODD 5000.1, AR 1000-1 and AMCR 11-16, Volume I. It is true that the CCE program does not qualify as a typically developed R&D system but what it does represent is a fairly large, funding level wise, program that has peculiarities that set it apart from other, normal non-development programs, that result in it being sort of in-between. It does not qualify for high level review and decision making, i.e., DSARC or ASARC but does require strong user-developer coupling and a need to expeditiously implement a supply support system that is acknowledged to be an exception to standard supply procedures. These

requirements and the fact that construction equipment is construction equipment suggest that the already established PM for "one-half" of the mission might well be in an excellent position to manage the "other half" with an overall net savings in staff resources, reduced overall coordinative effort and best use of the available expertise.

If a reasonable case can be made for consolidating the acquisition management function in the Army, the next logical step would be to ask, is there sufficient similarity/commonality in the equipment and mission, from service to service, to warrant optimizing the task in a single, perhaps DOD, program management office.

An example that may have some similarity to the construction equipment problem could be the rationalization of the services power generation programs. In 1967, as the result of a DOD Engine Generator study, a DOD program was established to effect management and standardization of mobile electric power generating sources to meet military needs. The situation that gave rise to the action was a shortage of right quantity and quality of generator sets, a large variety of sets in use, continued proliferation of the variety problem by separate service generated requirements and a large parts support program -- primarily caused by so many makes and models. Approximately 2,000 makes and models were identified (17:3-11). It was determined that the situation was caused by repeated small quantity procurements; use of performance specifications on a competitive basis without use of make or model standardization and differing requirements of each military service. The number of different sets is now set at 200. A relatively small R&D (3 million annually) program is pursued and procurement is about 30 million annually (18). The repair

parts problem has been minimized as a result of standardization and large economies and efficiencies have been realized as a result of centralized management. The program is on-going, with no current plan to de-projectize. It is not suggested that the generator requirement is the same as the construction equipment requirement but there are some similarities and it serves to indicate that centralization can and does work with beneficial results.

Another point to consider is duplication of effort. It is recognized that the Army's sister services do, at the present time, participate in Army buys where possible, and none engage in construction/earthmoving equipment R and D. What each of these services do have however is an acquisition management staff dedicated to the acquisition task. For example, in the Navy, The Equipment Management Department of the Civil Engineering Support Office of the Construction Battalion Center, Port Hueneme, California, has 50 persons engaged in managing/supporting the acquisition function (2). Each of the other two services have similar organizations. A complete centralizing of the overall task would thus formalize/institutionalize some existing practices between the services, but more significantly, if it can be supported, the overall effects may be a more complete rationalization of what some now feel is a fragmented, suboptimizing situation.

There are several areas contributing to commonality and mutual benefit in centralization. In this case, the interface is with one industry, the civilian construction equipment industry, for reliance on R and D effort and off the shelf support for the commercial item and modified commercial item. Single point of responsibility/contact has obvious benefits to both

the DOD and industry. Coordination and policy promulgation becomes simplified, duplication in staff effort is eliminated and ambiguities in differing requirements should disappear under unified action and representation of the need as voiced by a single authority. A single point of contact would facilitate interfacing with service headquarters for staffing and approval actions, would expedite decision/action, provide for the most control in effecting program changes/modifications, and would ease program funding actions. Standardization would more easily be realized under centralized management and deficiencies/problems in effecting integrated logistic support would be lessened. The overall logistic support area should become more manageable. There are additional benefits/economies of scale that could be realized from centralization that are related to concentration of effort. Some of these would include reduced overall staffing requirements, elimination of parochial interests, broader program coverage by smaller group, maximizes utilization of specialists during life cycle of projects and economies in maintenance and use of a consolidated data base.

SECTION VI

Conclusions and Implications

The construction equipment requirement resides primarily with the US Army. The Air Force, Navy and Marine requirement is comparatively small, mostly commercial type, and often satisfied along with Army buys. The Army requirement is now, or under current plans will be, satisfied by three basic programs; FAMECE/UET, currently product managed; CCE, currently special item managed; and CE, or MACI, currently managed on an item basis within the functional staff at TACOM. The overall Army program is fairly sizeable, amounting to about 50 million annually.

As a result of evolutionary trends in acquisition management within the Army, perhaps spurred by the AMARC study results, it looks as though a separation of the materiel development functions and the logistic or readiness functions, is taking shape at least in the TACOM organization. Should the Systems Development Center with the research and development mission and the Logistic Command with its readiness mission come to pass, it will be another step toward improving the imbalance between development and readiness and lessening of what the AMARC called fragmentation of authority and excessive procedures and systems of checks and counterchecks. The creation of the development center where authority and responsibility will reside for research and development through fielding, to include the support system, will give rise to benefits approaching those accruing to the "Basket SPO" concept in the US Air Force acquisition business.

There are some very hazy areas in responsibility for construction equipment research, and development in the Army. MERDC is the lead laboratory--

actually development center for "theater construction, earthmoving and clearing and highway maintenance equipment". With the exception of FAMECE, whose responsibility currently resides with TACOM, the MERDC mission covers the preponderance of the types of equipment we are concerned with. To further complicate the picture, some construction support equipment is the responsibility of US Army Troop Support Command, TROSCOM, the successor of Mobility Equipment Command, MECOM, while in point of fact, TACOM has command responsibility for all the major programs, FAMECE/UET, CCE, and the CE mission. If TACOM does in fact reorganize to TASDC and a TALC it makes imminent good sense to have the TALC manage fielded, supported systems and minor product improvement programs for these systems but as far as research and development is concerned, the right place appears to be MERDC. In this regard, the CCE program, by definition "off the shelf", might best be started (until each item is fielded and supportable) in a development center and not the logistic center.

Because of the great overall commonality of the construction function, the complementary nature of the FAMECE/UET and CCE programs, the singular industry interface situation, the flexibility and common coordinative requirements for construction items, and numerous other benefits and economies, the PMO makes a lot of sense for combining these programs. The arguments that FAMECE/UET are more generically identified with the combat support role whereas the CCE program satisfies an almost strictly combat service support requirement is surely a consideration and the fact that FAMECE/UET are full blown development items, running the full weapons acquisition process gauntlet, definitely separates it from the CCE concept. These differences notwithstanding, they do not seem to render the acquisition manage-

ment tasks as individually mutually exclusive activities and as has been mentioned, there are more than a few reasons contributing to benefits from such a centralization. Carrying the idea one step further, I believe that the idea of a DOD manager for construction equipment has some merit. The current situation implies that the Army is doing practically all the job as it is and formalizing it into a single management situation with single point responsibility seems to be an attractive thought.

The discussion and arguments presented above and in the text of this paper are certainly not exhausted by any means and do not by themselves represent a complete basis for a decision to act on the question of consolidation. However, I do believe that action is warranted in consolidating the Army R and D responsibility which implies assignment to MERDC. And, as a follow-on, there appears to be some justification for overall centralized management. This question though should be the subject of an official study of greater magnitude and depth.

Author's Note: Subsequent to the writing of this paper and prior to final typing, a HQ AMC Letter of Instruction dated 14 April 1975 (released week of 5 May), assigned development responsibility for "FAMECE and other construction equipment" to MERDC. The assignment further states "MERDC as developer will make the determination to go commercial, MACI, PIP or R&D. MERDC as the standardization assignee for construction equipment will maintain the single interface with the construction industry" (20). Obviously this action resolves at least part of the problem/question discussed in the paper and may lead the way to addressing the other questions.

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DEFENSE SYSTEMS MANAGEMENT SCHOOL

STUDY TITLE: ACQUISITION OF MILITARY ENGINEER CONSTRUCTION EQUIPMENT

STUDY PROJECT GOALS:

- To review the overall DOD requirement for construction equipment.
- To look at the current acquisition management organization/procedures for construction equipment and evaluate this situation.
- To determine if the management task can/should be centralized.

STUDY REPORT ABSTRACT

→ This study looks

The purpose of this study was to look at the acquisition management of military engineer construction equipment to determine if ~~aggregation under~~ centralized management might be more effective in achieving the overall management task. The approach used was to describe the principal programs and then determine who is managing what, and how it is being accomplished. A search was made for reports, studies and reports concerning the subject and then personal and telephone interviews were conducted with managers, supervisors and staff persons in selected ~~headquarters and organizations in an effort to determine just~~ how the management task is carried out. Problem areas and how they impact the situation were sought out and discussed. The study indicates that the US Army is the principal user in the DOD, and although each of the other departments has some requirement, there is no R&D effort outside the Army. Participation in Army buys was found to be often the case. The Army programs are well defined but there is separation and some division of R, D and E responsibility within USAMC. The situation is still in the process of change due to recent reorganization activities with the prospect of more to come as a result of the Army Materiel Acquisition Review Committee (AMARC) recommendations. The complementary nature of the programs, the single user and considerable commonality among requirements and interface problems, and the need for standardization and rationalization of a realistic parts support program in the Army, suggest that centralization of the management task may offer significant benefits that warrant further consideration and perhaps an official study of greater magnitude and depth.

KEY WORDS

**MATERIEL ACQUISITION ENGINEER EQUIPMENT CONSTRUCTION EQUIPMENT FAMECE
TRACTORS**

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